

ORIENTED POLYMER FIBRES FOR IMPROVING THE FLAME RETARDANT EFFICIENCY OF INTUMESCENT ADDITIVE SYSTEMS

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Recently, significantly enhanced flame retardant efficiency of common ammonium polyphosphate based intumescent system was found in self-reinforced polypropylene (PP) composites [1]. In this study, the observed novel flame retardant synergism evinced between intumescent additive system and highly oriented polymer fibres [2] has been investigated both in PP fabric reinforced, film-stacked composite sheets and in short-fibre reinforced, injection moulded all-PP composites.

After comprehensive mechanical characterization (tensile tests, impact tests and DMA analyses), the ignitability and combustion behaviour of the two types of flame retarded self-reinforced composites were monitored. The results were compared to simple melt compounded flame retardant compounds of identical low (up to 15 wt%) additive contents. SEM and EDS analyses supported the different intumescent mechanism of each kind of samples to be understood, while the structure and character of the (after combustion) obtained charred residues were examined by compression tests. Considering the results of all the applied testing methods, the complex picture of the mechanism behind the enhanced flame retardant efficiency in self-reinforced composites could be clarified. The observed outstanding efficiency is explained by the beneficial physical cooperation between the intumescent, i.e. expanding structure, and the shrinking of fibres. Such system, exposed to heat, forms charred surface layer of special, compact structure resulting in effective fire extinction.

It was concluded that the embedding of additive-free, highly stretched (oriented) fibres into the polymer matrix can basically change the burning behaviour (ignitability, char forming process, migration effects, etc.) of a flame retarded polymer system. It is prospected that high amount of flame retardant additives could be spared this way, and by this means a more cost-effective flame retardancy of polymers can be realized in the near future.

References

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